4. COST ESTIMATES

The Basis of the Estimate of Probable Construction Cost for Master Planned drainage improvements and the quantity derivation and basis for the unit prices for the construction cost estimates are presented in this chapter. The cost estimate methodology is outlined and detailed since these numbers form the basis for developing the drainage assessment fees for the Planned Local Drainage Area (PLDA) Fee Program. The following information is presented in the sections below:

- Class of Estimate
- Estimating Methodology
- Direct Cost Development
- Indirect Cost Development
- Bidding Assumptions
- Estimating Assumptions
- Estimating Exclusions
- Contractor and Other Estimate Markups

4.1 Class of Estimate

The cost estimate provided as part of this DMP Update is classified as a Class 5 estimate. A Class 5 estimate is defined as a conceptual level or project viability estimate. Typically, engineering for the drainage elements is up to 20 percent complete. Class 5 estimates are used to prepare planning level cost, scopes, or evaluation of alternative schemes. This type of long range capital outlay planning can also form the base work for Planning Level or Design Feasibility Estimates. Expected accuracy for Class 5 estimates typically range from -50 percent on the low side, to +100 percent on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. In unusual circumstances, ranges could exceed those presented above. This type of estimate (Class 5) is acceptable for the preparation of planning level costs to support the Carlsbad Drainage Master Plan Update.

4.2 Estimating Methodology

These estimates were prepared using information from proposed drainage infrastructure quantities presented in the 1994 DMP where appropriate, or quantity takeoffs, vendor quotes, and equipment pricing either furnished by the planning team or by the estimator, incorporating the methods described in the following paragraphs. The estimates include direct labor costs, a shift differential (if applicable), and anticipated productivity adjustments to the labor, operating, and use cost of the construction equipment as they apply to the project conditions. Where possible, estimates for work anticipated to be performed by specialty subcontractors have been used. Estimates were prepared using an estimating system, consisting of a Windows-based commercial estimating software engine using material and labor databases, modified to include historical project data and the latest vendor and material cost information, and other costs specific to the locale of the project.

Construction labor crew and equipment hours were calculated from production rates contained in documents and electronic databases published by R.S. Means, Mechanical Contractors Association, National Electrical

Contractors Association, Rental Rate Blue Book for Construction Equipment (Blue Book), and Richardson Engineering Services.

4.3 Cost Development

The unit cost for the various drainage features identified in this DMP Update have been derived from an average cost of construction for similar projects, having similar site conditions and availability of like equipment to perform the construction operation. Key assumptions are discussed below. Details on elements that make up the project costs are found in Appendix B.

4.3.1 Direct Cost Development

The costs associated with the General Provisions and the Special Provisions of the construction documents, which are collectively referred to as Contractor General Conditions (CGC), were based on the estimator's interpretation of typical contract documents. The estimates for CGCs are divided into two groups: a time-related group (e.g., field personnel) and a non-time-related group (e.g., bonds and insurance). Labor burdens such as health and welfare, vacation, union benefits, payroll taxes, and workers compensation insurance are included in the labor rates used. No trade discounts were considered.

4.3.2 Indirect Cost Development

Local sales tax has been applied to material and equipment rentals. A percentage allowance for contractor's home office expense has been included in the overall rate mark-ups. The percentage rate used is typical for this type of construction and is based on typical percentages outlined in the Means Heavy Construction Cost Data, latest edition.

The contractor's cost for builder's risk, liability, and vehicle insurance has been included in this estimate. Based on historical data, this is typically 2 percent of the overall construction contract amount. These indirect costs have been included in this estimate as a percentage of the gross cost and are added to the net totals after the net markups have been applied to the appropriate items.

4.3.3 Bidding Assumptions

The following are bidding assumptions considered in the development of the estimate:

1. Bidders must hold a valid, current Contractor's license in the state in which the project is being constructed and applicable to the type of project being constructed.
2. Bidders will develop estimates with a competitive approach to material pricing and labor productivity, and will not include allowances for changes, extra work, unforeseen conditions, or any other unplanned costs.
3. Estimated costs are based on a minimum of four bidders. Actual bid prices may increase for fewer bidders or decrease for a higher number of bidders.
4. Bidders will account for General Provisions and Special Provisions of the contract documents and will perform all work except that which will be performed by traditional specialty subcontractors as identified here:
    a. Saw cutting
    b. Paving
    c. Landscaping
    d. Traffic control

4.3.4 Assumptions on Contractor Activities

The following are the assumptions for the contractor's activities considered in the development of the estimate:

1. Contractor performs the work during normal daylight hours, nominally 7 A.M. to 5 P.M., Monday through Friday, in an 8-hour shift. No allowance has been made for additional shift work or weekend work.
2. Contractor has complete access for lay-down areas and mobile equipment.
3. Equipment rental rates are based on verifiable pricing from the local project area rental yards, Blue Book rates, and rates contained in the estimating database.
4. Contractor markup is based on conventionally accepted values and then adjusted for project area and economic factors.
5. Process Equipment vendor training using vendors' standard Operations and Maintenance (O&M) material, is included in the purchase price of major equipment items where so stated in that quotation.
6. Major equipment costs are based on both vendor supplied price quotes obtained by the project design team and/or estimators and on historical pricing of like equipment.
7. Bulk material quantities are based on manual quantity takeoffs that have been entered into the estimating program.
8. There is sufficient electrical power to feed the specified equipment. It is assumed the local power company will supply power and transformers suitable for this facility.
9. It is assumed that all of the subsurface soils are of adequate nature to support the structures. No piles have been included in the estimate.
10. No groundwater dewatering will be required.
11. Pipe burial depth equal to 4' from finish grade to top of pipe.
12. Import pipe bedding and backfill.
13. Off-site spoil disposal within a 20 mile round trip.
14. Pipeline runs are assumed to be straight runs. No allowances for fittings.
15. No rock excavation, blasting, hardpan etc. It is assumed soil material can easily be excavated.
16. Replacement asphalt will be applied at 4-inch thick.
17. No cement treated base, concrete paving beneath asphalt trench patching.
18. Trench box shoring only. No sheet piling or other type of shoring included.
19. No significant crossing of existing utilities.
20. All open cut construction. No boring, jacking, tunneling, directional boring or other trenchless methods of pipe installation.
21. No significant waterline, sewer line, or other utility removal and replacement.
22. No sidewalk, curb, or other concrete removal and replacement.
23. Suitable storage or lay down area available at no cost.

4.3.5 Estimating Exclusions

The following are the estimating exclusions assumed in the development of the estimate:

1. No hazardous materials remediation and/or disposal is required.
2. O&M costs for the project with the exception of the vendor supplied O&M manuals.
3. Utility agency costs for incoming power modifications.
4. Removal of soil contaminated by hazardous material.
5. Any permits beyond those normally needed for the type of project and project conditions are excluded unless otherwise noted.

4.4 Additional Costs

In additional to the cost of raw materials, equipment, and labor for construction of each facility, various fees and contingencies were added to the estimated cost. These include labor and material markups, subcontractor markups, equipment markups, sales taxes that must be paid by the prime contractor, a construction contingency, and various insurance and performance bonds. These additional costs are described below and are listed in Table 4.4-1.

Table 4.4–1. Typical Project Costs

Item	Rate (Percent)
Labor Mark-up	18.00
Material Mark-up	15.00
Equipment Mark-up	15.00
Subcontractor Mark-up	5.00
Sales tax (material)	7.75
Sales tax (equipment)	7.75
Material Shipping & Handling	2.50
Worker's Travel /Subsistence	0.10
Contractor General Conditions	12.00
Earthquake Insurance	0.10
Construction Contingency	20.00 - 25.00
Builder's Risk, Liability, Auto Ins.	2.00
Performance Bond	1.00
Payment Bond	1.00
Engineering Review Fees	10.00
Environmental Permitting	2.00 – 20.00

4.4.1 Labor Markup

The labor rates used and shown in the estimate were derived chiefly from the latest published State Prevailing Wage Rates where applicable. Where this is not applicable, the latest rates published by R.S. Means, (Means) are used. The Means Labor Rate Manual, (page v, paragraph 3), outlines those items that are not included in the published wage rates which are Payroll Tax and Insurance (PT&I), FICA, Medicare, Workers Compensation Insurance, travel subsistence, etc. Means notes that their published wage rates must be

adjusted to compensate for these items. The State Prevailing Wage Rates as they apply to the project are consistent with the wage rates published by R.S. Means, and identify the additional costs that are beyond the raw labor hourly rate. In addition to these, the General Contractor (GC) typically adds a percentage to each raw labor dollar to cover the following: overhead and profit, payroll and accounting cost, additional insurance, retirement, 401k contributions, and sick leave/vacation cost.

4.4.2 Materials and Process Equipment Markup

This markup consists of the additional cost the contractor must bear beyond the raw dollar amount for material and project/process equipment. This includes shop drawing preparation, submittal and/or re-submittal cost, purchasing and scheduling materials and equipment, accounting charges which include invoicing and payment, inspection of received goods, receiving, storage, overhead and profit.

4.4.3 Equipment (Construction) Markup

This markup consists of the costs associated with operating the construction equipment used in the project. Most GCs will rent rather than own the equipment and then charge each project for its equipment cost. The equipment rental cost does not include fuel, delivery and pick-up charges, additional insurance requirements on rental equipment, accounting costs related to home office receiving invoices and payment. The crew rates used in the estimate, however, do account for the equipment rental cost. Also, some of the larger contractors will have some or all of the equipment needed for the job, but in order to recoup their initial purchasing cost they will charge the project an internal rate for the equipment use which is similar to the rental cost of equipment. The GC will apply an overhead and profit percentage to each individual piece of equipment whether rented or owned.

4.4.4 Subcontractor Markup

This markup consists of the GC's costs for subcontractors who perform work on the site. This includes the costs associated with shop drawings, review of subcontractor's submittals, scheduling of subcontractor work, inspections, processing of payment requests, home office accounting, and overhead and profit on subcontracts.

4.4.5 Sales Tax (Materials, Process Equipment and Construction Equipment)

This is the tax that the contractor must pay according to state and local taxation laws. The percentage is applied to both the material and equipment the GC purchases as well as the equipment cost for rental equipment. The percentage is based on the local rates in place at the time the estimate was prepared.

4.4.6 Material Shipping and Handling

Material shipping and handling can range from 0.5 percent to 2 percent, and is based on the type of project, material makeup of the project, and the region and location of the project relative to central distribution cities. This covers delivery costs from vendors, unloading costs (and in some instances loading and shipment back to vendors for rebuilt equipment), site paper work, and inspection of materials prior to unloading at the project site. This percentage is typically adjusted based on the amount of materials and whether the vendors have included shipping costs in the quotes used to prepare estimates. This cost also includes the GC's cost to obtain local supplies, e.g., oil, gaskets, bolts, and the like, that may be missing from the equipment or materials shipped.

4.4.7 Worker's Travel/Subsistence

Travel and subsistence can be reimbursable if the contract requires a specialty contractor to perform work outside their home base. The current worker's travel and subsistence selected for this estimate will be 0.10 percent due to specialty work that may require a specialty contractor from outside the State of California.

4.4.8 Contractor General Conditions

General conditions are established during the contract negotiations. However, there are unforeseen occurrences that affect construction costs such as labor burden, material availability, to name a few. The current general conditions selected for this estimate is 12 percent due to unforeseen events that may be encountered in the field during the construction operation.

4.4.9 Earthquake Insurance

Earthquake insurance is supplemental insurance that covers against damage or loss caused by earthquakes. The current insurance coverage selected for this estimate will be 0.10 percent due to work that will be performed in a seismically active region.

4.4.10 Construction Contingency

The contingency factor covers unforeseen conditions, area economic factors, general project complexity, and items that are not designed due to the design development stage of the project that cannot be addressed in each of the labor and/or material installation costs. Based on industry standards, completeness of the project documents, project complexity at the current design stage, and area factors, this can range from 10 percent to 50 percent. The current contingency selected for this estimate will fall between 20 to 25 percent due to project size, increase in fuel costs, material shipping and material availability.

4.4.11 Builder's Risk, Liability, and Vehicle Insurance

This percentage comprises all three items. There are many factors which make up this item, including the contractor's track record for claims in each of the categories. Another factor affecting insurance rates has been a dramatic price increase across the country over the past 2 years due to domestic and foreign influences. Consequently, in the construction industry we have observed a range of 0.5 to 1 percent for Builder's Risk Insurance, 1 to 1.25 percent for General Liability Insurance, and 0.85 to 1 percent for Vehicle Insurance. Many factors affect each area of insurance, including the individual project complexity and the contractor's requirements and history. Rather than use numbers from a select few contractors, we believe it is more prudent to use a combined 2 percent to better reflect the general costs for projects within the region. The actual cost could be higher or lower based on the bidder, region, and insurance climate at the time the project is bid, and on the contractor's insurability.

4.4.12 Performance and Payment Bonds

Based on historical and industry data, performance and payment bonds can range from 0.75 percent to 1.25 percent of the project total. There are several contributing factors including such items as size of the project, regional costs, contractor's historical record on projects of this size and type, project complexity, and current bonding limits. The industry standard for performance and payment bonds is usually 1 percent for each. This figure has been determined to be reasonable, on average, for heavy construction projects.

4.4.13 Engineering Review Fees

Additional cost that will be encountered during the engineering of the construction projects are special site investigations, preparation of plans and specifications, reviews of plan and specification revisions, field surveys, contract change orders and modifications, and materials testing. Based on typical review time and coordination of documents, engineering fees will be set at 10 percent of construction costs.

4.4.14 Environmental Permitting

The proposed master planned projects along with their associated permits have been identified in Section 2.5 and in Table 2.9-1. Average project costs can be determined from the range of costs for individual permits. As discussed in Section 2.9.1 (Tiered Permit Cost for PLDA Projects), individual projects will vary with their level of complexity, proximity to protected habitat, analysis and size of project.

Typical costs for the US Army Corps (404 Permit) permits can fall between $4,000 to $25,000, having an average cost of $15,000. Similarly, the Regional Water Quality Control Board permit costs range from $5,000 to $15,000, with an average cost of $10,000. The typical Streambed Alteration Agreement from the Department of Fish and Game can cost from $10,000 to $25,000, with an average cost of $17,000. The typical California Coastal Commission Development permit can cost $5,000 to $10,000, with an average cost of $7,000. For projects that do not have an apparent cost, a budget of $10,000 has been applied to ensure a measure of environmental investigation.

Based on the individual project and the associated permits required, a permit cost can be determined by adding the average cost of permits based on the number of permits needed for individual projects. The individual environmental permit costs have been identified and have been incorporated (as a lump sum items) into the cost estimates in Appendix B. The typical permit costs can be between 2 to 20 percent of a project.

4.5 Construction Costs Estimates for PLDA Fee Program

The construction costs assumed for certain drainage infrastructure elements are presented below, including reinforced concrete pipe culverts, storm drain inlets, manhole cleanouts, junction structures, natural enhanced channels, and sedimentation basins.

4.5.1 Reinforced Concrete Pipe Culverts

RCP is typically made of mortar, aggregate, sand and steel reinforcing for structural integrity. It is typically utilized to convey water in conjunction with other structural appurtenances such as inlets, manholes and junction structures. The installed cost for RCP includes material cost for the pipe and all other costs associated with excavation, trenching, bedding, backfill, compaction, saw-cutting existing asphalt surface, pot holing, concrete patching, asphalt repaving and painting, hauling, and erosion control. All culverts for the master plan are assumed to be RCP. The length of all culverts, amount of repaving, and amount/type of appurtenances were taken from the master planned facilities identified in the 1994 MDSQMP, developed for revised alignments or as directed by the City. The average unit costs for culverts of various diameters were developed from updated construction cost estimates and are presented in Table 4.5-2 below.

Table 4.5-2. Cost Based on Pipe Diameter and Number of Associated PLDA Projects		
Reinforced Concrete Pipe Diameter (inches)	Average Material Cost per linear foot ($/LF)	Number of Projects
18	$ 121	2
24	$ 162	2
30	$ 234	3
36	$ 230	4
39	$ 285	1
42	$ 312	1
48	$ 317	1
66	$432	1
84	$ 546	1

4.5.2 Storm Drain Inlet

Storm drain inlets are typically made of mortar, aggregate, sand, and steel reinforcing for structural integrity. The typical drainage inlet is formed and built on the job site. The elevation of the frame and grate are, at grade, to allow for efficient interception of runoff from the pavement surface. It is typically used to convey water in conjunction with other structural appurtenances such as culverts, headwall and endwall structures. Installed costs of storm drains include material costs and other costs associated with excavation, trenching, bedding, backfill, compaction, saw-cutting existing asphalt surface, concrete patching, asphalt repaving and painting, hauling, and erosion control. All Master Plan drainage inlets are assumed to be made of concrete. The number of drainage inlets, amount of repaving, and amount/type of appurtenances were taken from the proposed master planned facilities identified in the 1994 MDSWQMP, developed for revised alignments or as directed by the City. The average unit costs for drainage inlets with assumed depths were developed from updated construction cost estimates and are presented in Table 4.5-3 below.

Table 4.5-3. Cost Based on Drainage Inlet Depth and Number of Associated PLDA Projects				
Drainage Inlet Depth (feet)	Average Material Cost per Drainage Inlet ($)	Cost for Frame and Grate ($)	Total Cost for Drainage Inlet ($)	Number of Projects
Less than 6 feet	1,100	500	1,600	7
Greater than 6 feet	1,500	500	2,000	4

4.5.3 Manhole Cleanouts

Manhole cleanouts are typically made of mortar, aggregate, sand and contain a steel reinforcing cage for structural integrity. The typical manhole cleanout is formed and built on the job site, or can be pre-fabricated and delivered as a monolithic structure. The elevation of the frame and metal cover are at grade, to allow for easy maintenance access. It is typically utilized where there are long runs of culverts, bends in the drainage system, or other minor culverts tie-in to a main trunk line. Installed costs of manhole cleanouts include material costs and other costs associated with excavation, trenching, bedding, backfill, compaction, saw-cutting existing asphalt surface, concrete patching, asphalt repaving and painting, hauling, and erosion control. All manhole cleanouts for the master plan are assumed to be made of concrete. The number of

manhole cleanouts, amount of repaving, and amount/type of appurtenances were taken from the proposed master planned facilities identified in the 1994 MDSWQMP, developed for revised alignments or as directed by the City. The table below summarizes the average unit costs for two typical manhole cleanouts with typical diameters of 4 and 8 feet. The average unit costs for manhole cleanouts with assumed diameters were developed from updated construction cost estimates and are presented in Table 4.5-4 below.

Table 4.5-4. Cost Based on Manhole Cleanout Type and Number of Associated PLDA Projects

Manhole Cleanout Diameter (feet)	Average Material Cost per Manhole Cleanout ($)	Cost for Frame and Cover ($)	Total Cost for Manhole Cleanout ($)	Number of Projects
4	2,000	500	2,500	13
8	4,500	600	5,100	1

4.5.4 Junction Structures

Junction structures are typically made of high grade concrete and contain a steel reinforcing cage for structural integrity that is designed for significant loading. Junction structures are formed and built on the job site, or can be pre-fabricated and delivered in parts for construction on site. The elevation of the frame and metal cover are at grade, to allow for maintenance access at greater depths. It is typically utilized where there are long runs of large diameter culverts, bends or drops in elevation across the drainage system, or where multiple large diameter culverts need to tie-in to a main trunk line. Installed costs of junction structures include material costs and other costs associated with excavation, trenching, bedding, backfill, compaction, saw-cutting existing asphalt surface, concrete patching, asphalt repaving and painting, hauling, and erosion control. All junction structures for the master plan are assumed to be made of concrete and have a reinforcing cage made of grade 60 steel. The number of junction structures, amount of repaving, and amount/type of appurtenances were taken from the proposed master planned facilities identified in the 1994 MDSWQMP, developed for revised alignments or as directed by the City. The average unit costs for junction structures with assumed diameters were developed from updated construction cost estimates and are presented in Table 4.5-5 below.

Table 4.5-5. Cost Based on Junction Structure Type and Number of Associated PLDA Projects

Junction Structure Diameter (feet)	Average Material Cost per Junction Structure ($)	Cost for Frame and Cover ($)	Total Cost for Junction Structure ($)	Number of Projects
4	4,500	600	5,100	9
8	6,000	500	6,500	1

4.5.5 Natural Enhanced Channels

The purpose of a natural enhanced channel is to accommodate stormwater runoff within its conveyance, create a reduction in the velocity of flow to minimize scour and to minimize sediment transport downstream. The design elements can be achieved by the introduction of gabion structures to reduce the velocity of flow within the channel, slope stabilization of the channel banks with man-made or vegetative materials, and a reduction in the slope of the conveyance, where feasible.

The typical number of gabion structures to be installed depends on the average slope and length of the conveyance channel. To achieve stability in the channel and reduce scour through the conveyance, the average velocity of stormwater runoff must be maintained at or below 5 feet per second. It will be further assumed that the proposed spot enhancements will be installed within 300 to a maximum reach of 800 feet.

Slope stabilization of the banks, when necessary, can be achieved by the installation of a geo-textile fabric along the side slope of the channel. It will be assumed that the geo-textile fabric will be installed along the whole reach of the channel, and typically defined within the gabion structures. It is anticipated that temporary access will be granted and, in some cases, there is the possibility that an access road may have to be installed. Care shall be taken to select existing roads where feasible and to minimize the footprint of the access to preserve the surrounding vegetation. The average cost of proposed spot enhancements within natural enhanced channels is approximately $180/linear foot of channel.

4.5.6 Detention and Desiltation Basins

Detention and desiltation basins are manmade drainage features that can be unlined to take advantage of infiltration or can be concrete lined for ease of maintenance. Basins will incorporate an entrance weir with a bypass structure to minimize overtopping during heavy rainfall events. The outlet structure will incorporate an exit weir to meter the runoff and reduce velocity at the outfall. The basin will be designed to contain a specified volume of runoff so that it has a sufficient containment time so that it can deposit its sediment load prior to discharge. In addition, vegetative enhancements will be incorporated along the perimeter and within the confines of the basin where feasible. The detention and desiltation basins will be able to contain a minimum volume of stormwater and sediment based on available land area.

4.6 Costs Estimates for O & M Non-PLDA Projects

As discussed in Section 2.6, the City is charged with the repair, restoration, operations and maintenance for the infrastructure components within its boundaries. As part of their future projections, a range of general labor costs for repair, restoration, operations and maintenance projects can be determined using general City labor hourly rates. For this cost analysis, labor costs will be determined for a total (8-hour) day of work. Based on typical work encountered by City forces and general labor categories, the following assumptions will be used:

- $100/hr for general labor, hand tools and truck (L-1)
- $150/hr for labor (driver), hand tools and dump truck (L-2)
- $200/hr for labor (operator), and light to medium duty equipment such as utility loader, small to medium backhoe, trencher or excavator, compactors and jackhammers (L-3)
- $250/hr for specialty labor (operator), and specialty equipment such as front end loader, large backhoe, large trencher or excavator, tracked rollers or compactors, and large jackhammers (L-4)

These hourly rates do not take into account maintenance personnel experience or seniority; overtime or holiday pay scales; or inflation. In addition, the labor estimates do not include permit fees that may be required to begin the work; materials that have to be purchased to complete the work; or hauling and disposal costs that may be accrued due to the work. Costs for traffic control and temporary street closures are not included. Worker safety requirements will be enforced at all times. Furthermore, it is also understood that repair work that may be beyond the capabilities of City forces, will be scheduled as needed or when appropriate, and may be completed under an on-call contract (small, medium, large or emergency) where the appropriate permits will be secured.

4.6.1 Category 1: Inlet/Outlet and Channel Maintenance

Routine maintenance activities typically include vegetation control, tree trimming, and debris removal including trash, rocks and sediment. The labor required will vary depending on the length and condition of the channel. However, for estimating purposes, it can be expected that channel maintenance work will take at least one day. The labor to perform these activities will generally entail a crew of four (L-1, L-2, L-2, L-3) with their appropriate support equipment. An expected labor cost to perform channel maintenance work is about $4,800 per day. Fees for hauling and disposal of deleterious material will depend on the amount of material removed, distance to disposal site and number of round trips per truck. There is no expectation to bring in imported material.

4.6.2 Category 2: Existing Facilities Repair

Routine repairs include work related to stormdrains, culverts, inlets/outlets, channels, brow ditches, basins, existing erosion control features including fiber rolls, silt fences, erosion control blankets, hydroseed, and structural Best Management Practices (BMPs [sediment/detention basins, bio-strips, bioswales, and check dams]), for roadways and other drainage facilities previously described. Facility repair may also include repairing scoured channel bottoms, bridge piers and abutments, damaged headwalls, concrete aprons, damaged spillways, curb inlets, brow ditches, broken pipes and energy dissipaters. It is understood that the labor required will vary depending on the size and condition of the facility. However, for estimating purposes, it can be expected that facilities repair work (general patch work) will take at least one day. The labor to perform these activities will generally entail a crew of three (L-1, L-3, L-3) with their appropriate support equipment. If work takes a full day, an expected labor cost to perform facilities repair work is about $4,000 per day. Fees for hauling and disposal of deleterious material will be negligible. If there is an expectation to bring in imported material, costs will increase based on level of effort and time on the job site. There may be a need for traffic control on the job site.

4.6.3 Category 3: Facility Rehabilitation/Upgrades

Facility rehabilitation/upgrades are projects such as sediment/detention basin upgrades (increase in size and/or depth), culvert replacements (increase in size, diameter or type of culvert), culvert slip lining (to maintain line and grade where feasible), access to drainage facilities, construction and upgrades to erosion control features and structural BMPs, (fiber rolls, wattles, mats, erosion control blankets, rock slope protection, silt fences, hydroseed, etc.), and placement of concrete or rock slope protection (bank armoring). It is understood that the labor required will vary depending on the size and condition of the facility. However, for estimating purposes, it can be expected that the work will entail a minimum of three days to perform site preparation, demolition and rehabilitation/upgrades, and site clean up. The labor to perform these activities will generally entail a crew of four (L-1, L-1, L-2, L-3) with their appropriate support equipment. It is expected that labor cost to perform facility rehabilitation/upgrades work will be about $4,400 per day (or a total of $13,200 for three days). Fees for hauling and disposal of deleterious material will depend on the amount of material removed, distance to disposal site and number of round trips per truck. There is an expectation to bring in imported material, thus, costs will increase based on imported material, level of effort and time on the job site. There may be a need for traffic control on the job site.

4.6.4 Category 4: Culvert Replacement and Roadway Rehabilitation

Culvert replacement and roadway rehabilitation consists of replacing/retrofitting failed culverts with the same size/diameter culvert (essentially replacing in-kind) and extending culverts. Replacement work typically requires the excavation, removal and replacement of existing pipes, and backfill over the new culvert, as well as construction of a paved structural section (asphalt concrete or portland cement concrete) to match existing

site conditions. It is understood that the labor required will vary depending on the length of pipe that requires removal and replacement, as well as, the length of paved section needed to complete the work. However, for estimating purposes, it can be expected that the work will entail a minimum of three days to perform site preparation, demolition and removal, replacement and site clean up. The labor to perform these activities will generally entail a crew of four (L-1, L-2, L-4, L-4) with their appropriate support equipment. It is expected that labor cost to perform the culvert replacement and roadway rehabilitation work will be about $6,000 per day (or a total of $18,000 for three days). Fees for hauling and disposal of deleterious material will depend on the amount of material removed, distance to disposal site and number of round trips per truck. There is an expectation to bring in imported material, thus, costs will increase based on imported material, level of effort and time on the job site. There will be a need for traffic control enforcement on the job site.

4.6.5 Category 5: Bridge Rehabilitation/Replacement

Bridge rehabilitation generally consists of asphalt concrete (AC) deck removal or deck replacement, reconstructing approaches, bridge abutments and column protection, applying a seal coat, and sand blasting the bridge to inspect for damage, as well as, replacement of dikes, barrier rail and other appurtenances on the structure. It is understood that the labor required will vary depending on the length of deck that requires demolition and removal, as well as, the length of paved section needed to complete the work. However, for estimating purposes, it can be expected that the work will entail a minimum of at least five days to perform site preparation, demolition and removal, rehabilitation/replacement and site clean up. The labor to perform these activities will generally entail a crew of five (L-1, L-1, L-2, L-4, L-4) with their appropriate support equipment. It is expected that labor cost to perform the bridge rehabilitation work will be about $6,800 per day (or a total of $34,000 for five days). Fees for hauling and disposal of deleterious material will depend on the amount of material removed, distance to disposal site and number of round trips per truck. There is an expectation to bring in imported material, thus, costs will increase based on imported material, level of effort and time on the job site. There will be a need for traffic control enforcement on the job site.

4.6.6 Category 6: Storm Drain Infrastructure Repair

Curb inlets and junction structure repair consists of replacing/retrofitting damaged or aging drainage inlets, sidewalk underdrains, manholes and junction structures with the same size facility (essentially replacing in-kind) for the purpose of providing safe, accessible access to the maintenance personnel. Storm drain structure replacement consists of removing and replacing the entire structure and its appurtenances with a new drainage inlet, manhole and/or junction structure. It is understood that the labor required will vary depending on the depth and size of the structure that requires demolition and removal, as well as, the square area of paved section needed to complete the work. However, for estimating purposes, it can be expected that the work will entail a minimum of four days to perform site preparation, demolition and removal, concrete forming and pouring, and site clean up. The labor to perform these activities will generally entail a crew of five (L-1, L-1, L-2, L-3, L-4) with their appropriate support equipment. It is expected that labor cost to perform the storm drain infrastructure repair work will be about $6,400 per day (or a total of $25,600 for four days). Fees for hauling and disposal of deleterious material will depend on the amount of material removed, distance to disposal site and number of round trips per truck. There is an expectation to bring in imported material, thus, costs will increase based on imported material, level of effort and time on the job site. There will be a need for traffic control enforcement on the job site.

4.6.7 Category 7: Sedimentation/Retention/Water Quality Basin Maintenance & Repair

General basin maintenance and repair consists of removal and repair activities that may include vegetation, sand, silt, debris, and other deleterious material. Maintenance required for concrete lined basins include the

use of epoxy sealant, concrete patching of damaged areas, cleaning or replacement of inlet and outlet structures and graffiti removal. It is understood that the labor required will vary depending on the size and type of basin, amount of vegetation and debris encountered, as well as, the amount of haul and disposal needed to complete the work. However, for estimating purposes, it can be expected that the work will entail a minimum of at least two days to perform site cleanup, removal and repair. The labor to perform these activities will generally entail a crew of five (L-1, L-1, L-1, L-2, L-4) with their appropriate support equipment. It is expected that labor cost to perform the bridge rehabilitation work will be about $5,600 per day (or a total of $11,200 for two days). Fees for hauling and disposal of deleterious material will depend on the amount of material removed, distance to disposal site and number of round trips per truck. There is no expectation to bring in imported material, thus, costs will only increase based on level of effort and time on the job site.